Medical Cost of Burn Patient in National Trauma and Orthopedic Research Center, Mongolia

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Abstract

Background: The accidents and injuries are the major causes of the morbidity and mortality as the 90% of them occurring in the low- and middle-income countries. And the burn injuries are becoming more public health issues throughout the world. The cost of caring for a burns patient is known to be higher than for non-burns patients. However, there is little written on the cost of burns care. Studies of burn injuries are commonly related to hospital utilizations and its costs but there are needs to define how much money spent from the patient for the burn care.

Methods: Totally 116 burn patients who hospitalized at National Traumatology and Orthopedic Reseach Center (NTORC) participated in the study between the August 1st, 2016 and August 31st, 2016. We analyzed demographics and medical costs of adult (age>20) and child (age<11) patients. In this study, we created multiple linear regression model and logistic regression model to predict the medical cost of the burn patient.

Results: The mean of total out-of-pocket costs of burn injuries in NTORC were 536902.65 MNT (241.89 USD) per inpatient. As a result of multiple regression model among adult patients, that inpatient who lives in the rural area spend 461327 MNT more than inpatient who lives in the urban area. Besides, insured patients spend 261973 MNT more than the uninsured patient. The employed patient pays 433732 MNT more than the unemployed patient. The total cost of burn inpatient treatment for the adult patient will increase 16284 MNT if the percent of total body surface area (%TBSA) increase by 1 percent. And multiple regression model among child patients, inpatient who live in the urban area spent 127801 MNT more than inpatients who live in rural area. Also, insured patients spend 65951 MNT more than the uninsured patient. The only %TBSA was a significant predictor of the total cost of burn inpatient treatment. The total cost of burn inpatient treatment for child patient

will increase 10955 MNT if %TBSA increase by 1 percent. We did not find many statistically significant variables from logistic regression models of both adult and child patients. However, middle education levels for both models of adult and child patients were statistically significant. Exp (B) value indicates that when middle education is raised by one unit the odd ratio is 33 times as large and therefore children are 33 more times likely to show high-cost and it was almost two times higher than adult patients in our study.

Discussion: Our study objective was to determine the medical cost of burn patients in burn inpatients. The mean total medical cost per burn patient was 536902.65 MNT (241.89 USD) per patient within one-month treatment in NTORC. Our result of mean total medical cost per burn patient can not represent the true cost of the burn patient. Because we only studied one-month costs which paid by burn patient. Sanchez et al., (2007)'s study mentioned medical costs represent only 10% of total costs. In other words, other 90% of costs include costs of productivity losses and informal care (Sánchez et al., 2007). Mashreky et al., (2008) assessed the burden of burn injury costs and burn admission was significantly (p=0.000) high in a younger age group in their study results (Mashreky et al., 2008). But in our case, mean total cost of burn patient among adult patients (667677 MNT) was higher than child patients (443776 MNT). Similarly, Hop et al., (2016)'s study results show that adult patients were significantly costly than children. Klein et al., (2008)'s study conducted to evaluate the potential impact of the urban and rural area on hospital costs of the burn patient. The most rural areas tended to have higher costs in this study (Klein et al., 2008). It is similar to our result of location. According to our results, the size of burn surface area, location, employment status, insurance are the most influential indicators. More statistically significant variables found in multiple linear regression model than logistic regression model in our study. Further study is needed to continue to examine the costs related to burn injuries.

I. Introduction

A. Background

The accidents and injuries are the major causes of the morbidity and mortality as the 90% of them occurring in the low- and middle-income countries. Therefore, it is necessary to define the low- and middle-income countries' public health priority tasks including the costs of the accident, injury and prevention programs (WHO 2011; Mock, 2009).

The burn injuries are becoming the public health issues throughout the world. More than 300.000 deaths caused by fire burns and even more deaths caused by other burns such as thermal, electrical and chemical burns etc (Peck, 2011; Mock, 2009). Deaths are only part of the problem. For every person who dies from burns, many more are left with lifelong disabilities and disfigurements. These in turn have further consequences, including stigma, rejection, and economic loss, both for the burn victim and their family(WHO, 2011). And there is little written on the financial cost of burn care (Pellatt, Williams et al. 2010).

Mongolia is one of the leading countries in the Western Pacific by mortality rate. The standardized mortality rate by age (per 100.000 population) in Mongolia was 1.119 in 2012 (WHO 2012). From 2004 to 2014, the major causes of the deaths in Mongolia were 34.3% of the cardiovascular diseases, 24.3% of the cancer, 16.8% of the accidents, injuries and poisoning, 7.7% of the digestive system diseases, 3.5% of the respiratory diseases or 86.5% of them were accounted for the total deaths (CHD 2014). The dominant causes of deaths from the accidents and injuries in 2010-2014 were from the traffic accidents /V01-V99/ 25.7%, from the falls /W00-W19/ 20.2%, from burn injuries /X00-X19/ 17,7%, from the suicides /X60-X84/ 0.7%, from assault /X85-Y09/ 13.4% and other external causes /W20-64, W75-99, X50-59, Y10-89, X30-39, X49/ with 22.3% (NTORC 2015).

In 2002-2008 “The national program to prevent the injuries” projects were implemented in Mongolia approved by the Resolution No. 156 of 2002 by the Mongolian Government. The objective of this program was aimed to reduce the disabilities caused by the injuries, the losses of the working abilities and the mortality among the people. In 2009, by the Resolution No. 279 adopted by the Government was approved “The national program to prevent the injuries and violence” and were implemented in two phases for 2010-2012 and 2013-2016. This program was aimed to reduce the risk factors of the injuries resulting from the accidents and to prevent the violence by improving the health care services and their accessibilities including the implementation of the international standards and the reduction of the negative consequences.

The implementation of the appropriate objectives as the medical services during the accidents and injuries, improvement of the service quality and its accessibilities including the knowledge of the patient’s health status where their financial possibilities were appropriate to the medical costs and expenses would be the possible ways to achieve these goals. Therefore, there is a need to determine the cost of burn care in order to provide the care and services in the burn injuries.

B. Study objective

This study’s objective is to determine the medical cost of burn patient who hospitalized at NTORC in a Mongolian context. In doing so, we illustrate the significant costs which can be more impact on the medical cost and also we wanted to predict the total medical cost of burn patient in our study.

II. Literature review

A. Health financing system and legal framework of Mongolia

The 100% of the health care service providers based on the principles of the centrally planned economy was structured and financed from the state before 1990 but since 1990 after the transition to the democracy and free economic system the issue related to the renewing changes of the Mongolian health care system has been placed in the high priority place. So the first "National Health Insurance Act" was approved in 1993 and it was transferred to the system of the compulsory health insurance from 1994. This law from the beginning of its adoption had 9 amendments and it was revised in 2002.

The health insurance activities were affiliated to the Mongol daatgal (Mongolian Insurance) company in 1994 and from January 1st of 1996, it was transferred to the Social Insurance Authority in accordance with the Resolution No. 195 of the Government of Mongolia (Dashzeveg, 2008).

In the beginning, the number of the covered people in the Health Insurance System was 90% but was decreased later to 80% with 77.6% in 2009 and 82% in 2010. All of the officially registered workers in both public and private sectors were covered by the insurance. By 2009, this group accounted 25.7% of the insured people with the 80.5% of income from health insurance. But approximately 20 percent of the people are not entering to the coverage of the insurance as they were the people from the vulnerable part of the informal sector. About 80% of the population was covered by the insurance with the sustainable funds but has failed to meet the objective of the efficient care delivery and to improve the quality of the aid. In 2011, from 64.2% of the inpatient's treatment paid by the Health insurance funds, 15.9% of the funds were spent for the home treatment, 6.7% for the diagnostic tests, 3.3% for the drug discounts and 6.7% for the daily caring and healing services. The 2nd and 3rd phased health

care services were financed from the Health insurance funds. The health care services related to the infectious diseases, mental and cancer illnesses including the services related to the social reasons as the life-saving emergency and pregnancy services are financed from the state budget. Other services primarily financed by the Health insurance funds. The health care services in the 1st phase are financed from the state budget too. The financing of the household's health care services is granted on the basis of the cost per capita. The hospitals are financed from 3 sources such as the budget, insurance, and their own income. The fixed costs of the hospitals financed from the budget and the variable costs from the Health insurance funds. Also, the hospitals have own revenue plans which consist from the co-payments and paid services.

There are the following legal and policy documents to implement the health policies in Mongolia:

Table 1. Legal and policy documents of health policies of Mongolia

No.	List of documents
1.	Health cares law
2.	Sanitation law
3.	Drugs and medical devices act
4.	Social insurance law
5.	National Millennium development goals
6.	National poverty reduction strategy
7.	Master plan for the health care sector (2006-2015)
8.	The orders of the Minister of Health

The health insurance funds are consisting from the following sources in accordance with the Civil health insurance laws (Table 2) (Tungalag K et al., 2010).

Table 2. Sources of Health insurance funds of Mongolia

No.	List of funds
1.	The health insurance payments paid by the insurers
2.	The payments paid by the employers
3.	The payments paid by the state for the people receiving state contributions and subsidies, the interests from the savings consisting of the free state funds
4.	Other sources

The costs for the health care services paid from the diagnostic related funds including their value and weight were assessed by the Resolution No. 19 of the National Social Insurance Board in 17 may 2016 (Table 3).

Table 3. The amount of the payments for the Healthcare services to be paid from the variable costs insurance fund /in MNT/

No.	Support and service types	To the state-owned health care institutions	To the privately-owned health care institutions
1.	Inpatient cares services	300.000	175.000
2.	Daily treatment services	135.000	
3.	Outpatient services	15.000	
4.	Diagnosis and analysis	55.000	

5.	Traditional treatments		117.000	117.000
6.	Rehabilitation services		110.000	110.000
7.	Relief assistance and services		300.000	175.000
9.	Cancer care and services	Chemical treatment	450.000 /for each case/	
10.		Radiation therapy	66.000 /daily/	
11.		Relief assistance and services	300.000 /for each case/	

According to the revised health insurance law of 2016 if the total medical cost of the member covered by the household insurance plan exceeds the upper annual limit (MNT2.000.000) the estimated rest of the cost will be taken from another family member's annual insurance funds by permission from this person.

B. Current situation of burn injuries in Mongolia

According to the statistical data for the Mongolian population's health, the mortality rate from the injuries are in the 3rd place from the total deaths and the accidental illnesses are in the 5th place from the total numbers of the population's illnesses.In the last 5 years, the number of the customers received the emergency assistance from the National Traumatology and Orthopedic Reseach Center were increased, from the 5-years average of 2014 increased by 7.401 people and in 2010 by 15.304 people. During 2010-2014, burns were /T20-T31/ 10,36% of total injuries and 17,7% by the mortality causes where the mortality causes the burns were increased from 2,27% to 3,97% (NTORC 2015).

Mongolian population counted as 3.057.8 million by the end of 2015 and has increased by 2.1 percent, comparing to the year before. 68.6% of these population is living in the urban

area, and the remaining 31.4% is living in the rural area. In addition, the Ulaanbaatar is the largest and capital city in the Mongolia which has 1.396.3 million population which is 45.7% of the total Mongolian population in 2015.

Mendsaikhan (2014) reports that 80% of residents (residential community) of Ulaanbaatar city is receiving inpatient care, and 90% is receiving emergency care due to accidents and injury at the NTORC.And they note that the number of clients received emergency care due to accidents and injuries is continually increasing for last 5 years at the NTORC. The number of inpatients in 2012 is reduced comparing to a year before. But in 2013, it has increased by 10.9% than in 2012. Also, the increase of 10.0% is observed in the last 5 year's average (Z.Mendsaikhan, 2014).

In Mongolia, 160 thousand of injuries recorded annually and emergency department of NTORC received more than 80 thousand injuries of it.

Following causes were leading causes averaged over the last 5 years (2011-2015) which recorded at the department of emergency (NTORC, 2015):

Table 4. Leading causes of injuries in Mongolia

No.	Causes of injuries	Percentage (%)
1	from the falls /W00-W19/	37.20
2	external causes /X85-Y09/	18.93
3	traffic accidents /V01-V99/	15.02
4	exposure to inanimate mechanical forces /W20-W49/	14.64
5	exposure to heat and hot substances (burn) /W85-X19/	5.82
6	exposure to animate mechanical forces /W50-W64/	4.78

According to NTORC's statistical data shows that burn is 4th ranked cause of leading

causes of mortality which averaged over the last 5 years (2011-2015).

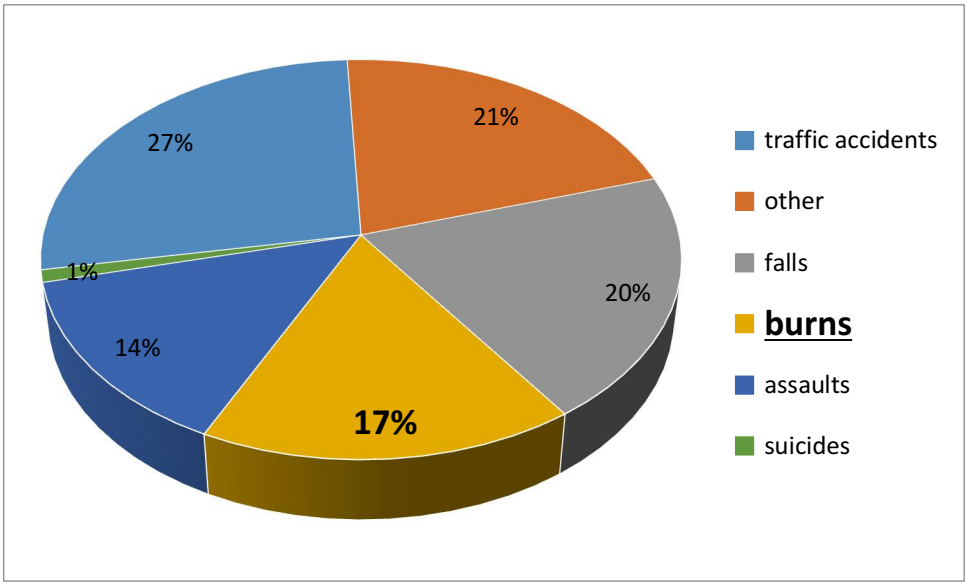

Figure 1. Leading Causes of Unintentional and Intentional Injury Mortality

In study result which conducted by Amgalanbaatar (2011) shows that the most common cause of trauma /illness among children aged 0-5 was burn from heat and chemicals (T20-T25, T26-T28, T29-T32). They also concluded that burn injuries slightly increases in May, June and October (N.Amgalanbaatar et al., 2011).

By the end of 2015, 76% of total inpatients who hospitalized at Department of Burn and Reconstructive Surgery, NTORC were under 20 years old inpatients and its 91.3% was 0-5 years old children. Moreover, 82.3% of total inpatients has 3rd-degree, 17.4% has 2nd-degree and 0.3% has 1st-degree burn (NTORC 2015).

C. Definition of burn and burn classification

A burn is an injury to the skin or other organic tissue primarily caused by heat or due to radiation, radioactivity, electricity, friction or contact with chemicals. Skin injuries due to ultraviolet radiation, radioactivity, electricity or chemicals, as well as respiratory damage resulting from smoke inhalation, are also considered to be burns (WHO, 2013).

The burning types

While the burning type commonly happening to the children is the contact of the skin with the hot liquids, then for the adults are happening from the fire. There are the following common types of the burns seen in the children and adults are heat burns, chemical burns, electrical burns, respiratory tract burns, radiation burns, the cold temperature burns.

The classification of the burns.

The skin burn is classified as follows depending on the damaged depth of the tissue:

- 1st-degree (superficial)
- 2nd-degree(partial thickness burn)
- 3rd-degree(full thickness burn)
- 4th-degree(covers the tissues under the skin, muscles, and bones)

The burns are not uniform in depth and they have deep and superficial burns. It is hard to make the precise classification of the burn's injuries and it takes up to 3 weeks to make the final decisions. The depth of the burns. The burns are traditionally divided by their depths as the superficial, superficial partial thickness, deep partial thickness, and full thickness.

Also, the American Burns Association (ABA) has identified the severity of the burn injuries with the following symptoms as minor burns, moderate burns, and major burns (Hartford, et al., 2007).

D. Cost categorization and %TBSA burn

We categorized inpatient's costs as intensive care unit (ICU), non-intensive care unit (Non-ICU), surgery cost, drugs cost, fluids cost, dressing cost, oil cost, diagnosis cost, food cost, travel cost, personal consumables cost and medical consumables cost. Cost breakdown analysis can be helpful to determine which group associated with percent of total body

surface area (%TBSA) burn affect what category of costs mostly (Ahn, et al., 2012). Inpatients can be divided by 4 groups associated with %TBSA (0-9%, 10-19%, 20%-29%, >30%) in order to compare costs between these groups.

E. Empirical studies related to burn injury's cost and burden

According to our literature review, burn care costs include all costs associated with burn injuries such as hospital length of stay, all medication costs, medical consumables, dressing materials, investigation costs and non-medical costs such as dietary costs, transportation costs (both patients and their caregivers). Bottom-up costing approach was used in retrospective studies of burn care costs (Ahuja et al., 2013). And the percent of total body surface area (%TBSA) burned, the area of thickness was significantly corresponded to burn costs. Burn care costs are higher than other injury costs (Ahuja, 2013; Hop, 2016; Klein, 2008; Ahn, 2012; Nguyen, 2015; Sahin, 2011;). A cost-related evaluation and full economic evaluation are initial work to describe the economic burden of injury (Drummond, et al., 2005).

In our research review, we found two significant articles. One of them reviewed the cost of injury and trauma care in LMICs (Wesson et al., 2014) and the second article reviewed the cost of burn care systematically (Hop et al., 2014). Injuries are a significant cause of mortality and morbidity, of which more than 90% occur in low- and middle-income countries (LMICs).

Wesson et al., (2014) categorized all studies into two main groups such as full economic evaluations and partial economic evaluations in their research review (Wesson et al., 2014).

Full economic evaluations included cost-effectiveness analysis, cost-utility analysis, and cost-benefit analysis. For full economic studies, costs were reported in units of costs per

disability-adjusted life year (DALY) averted, per death averted and per years of life gained, as defined by the individual study (Drummond et al., 2005).

For partial evaluations studies, mean costs were reported in units described by the individual study, such as the cost per hospitalization or cost per injury. Partial economic evaluations were grouped into four categories: 1) 'cost description' which examined only costs without a comparison to alternative outcomes; 2) 'cost analysis' which compared alternatives in terms of costs only; 3) 'cost outcome description' which examined both costs and outcomes, but did not compare alternatives; and 4) 'outcome analysis' which compared alternatives in terms of outcome only (Drummond et al., 2005).

In Wesson et al., (2014) research, they mentioned there is a significant number of studies about the cost of injury but only 13 studies performed full economic evaluations in 14 of 144 LMICs as classified by World Bank (Wesson et al., 2014). Also, they found three cost analysis studies in their research review. Those studies categorized into cost analysis studies of partial economic evaluations and those studies were about road traffic injury and road safety.

Hop et al., (2014) research reviewed burn cost studies (n=153) but nearly all of the studies (n=139) were from high-income countries. The mean total healthcare cost per burn patient in high-income countries was $88,218 (range $704–$717,306; median $44,024) (Hop et al., 2014). In their study, costs were categorized into four groups such as direct medical costs direct medical costs (e.g., the cost of hospital stays), indirect medical costs (e.g., the cost of care during life years gained), direct nonmedical costs (e.g., traveling costs), and indirect nonmedical costs (e.g., productivity loss). The majority of studies (n = 143) only included direct medical costs. And the most studied cost component was hospitalization (n = 96), followed by dressing (n = 34), medication (n = 28), and surgery (n = 22).

In Hop et al., (2014) reviewed studies, comparison of cost levels between high- and low- and middle-income countries showed substantial differences in mean costs per patient ($88,218 vs. $5,196). And significant reviews in their studies were "%TBSA burned seemed to be a stable predictor of burn costs with a mean price $4,097 per 1% TBSA burned" and "the most expensive burn care component was hospital stay". Also, they mentioned cost studies in low-income and mid-income countries are limited in number (Hop et al., 2014).

The financial burden for health care can be defined as the ratio of total household out-of-pocket spending for health care services and premiums over household income. Their study result shows that the financial burden was highest among poor and low-income people with private insurance. Also, they found that 53.5 percent of poor and 37.4 percent of low-income people with private insurance faced a high financial burden in 2004 (Banthin et al., 2008).

Banthin et al., (2006)'s study considered total burden included all out-of-pocket expenditures for health care services, including premiums. And health care services burden excluded premiums and, when applied to the insured population, was used to identify the underinsured. They defined health care service burdens in excess of 10% of tax-adjusted family income in their study (Banthin et al., 2006).

Banthin et al., (2008)'s study considered a measure that uses a lower threshold for low-income people (people whose out-of-pocket costs exceed 5 percent of income for low-income people and 10 percent for all others) because it is assumed that low-income people have much less capacity than higher-income people peers (Banthin et al., 2008).

Karimi et al., (2015)'s prospective, over a two-year study which conducted in Iran focused on the financial burden of burns. They calculate direct costs of managing in-hospital acute burns and compared the results with other study results. The questionnaire used to gather all patient demographic factors such as age, sex, inhalation injury, the length of time from injury to care, accompanying traumas, place of burn, total surface area of burns, the cause of burns,

the degree of burns, ICU admission, the length of hospital stay etc. And they calculated total expenditure during stay, total %TBSA burn involvement for all patients, total length of stay of all patients, mean %TBSA burns, mean cost of treatment per patients, maximum treatment cost, minimum treatment cost, mean length of hospitalization, average cost of treatment per patient per day, and the average cost of treatment per patient per %TBSA. As a result, they concluded insurance coverage of the costs plays a significant role in decreasing the financial burden of burns for the patients. According to their literature review, 85 percent of burns occur in low and middle-income countries but still the reports about the cost of burn treatment in these countries are rare (Karimi et al., 2015).

Another study of the financial burden of trauma care which conducted by Kaya et al,. (1999) in Turkey. They used medical, demographic, and financial records of trauma patients. As a result, they concluded trauma care is expensive and reimbursement is not always possible, but the hospital's non-reimbursed money was within tolerable limits (Kaya et al., 1999).

Kilburn et al., (2014)'s study result shows the financial burden related to the injury posed the greatest impact on parents and was mainly associated with making the journey to the hospital, with lower income households being most affected (Kilburn et al., 2014).

According to our literature review, we found that cost studies of burn injuries were very limited in numbers. Dorjdagva et al., (2016) estimated the rate of catastrophic health expenditure and impoverishment due to the out-of-pock payments for health care using the Household Socio-Economic Survey 2012 in their study (Dorjdagva et al., 2016). Their study result shows that 5.5% of total households suffered from catastrophic health expenditures based on an out-of-pocket threshold at 10% of total household expenditure but at the

threshold of 40% of capacity to pay, 1.1% of total household incurred catastrophic health expenditure.

Yundendorj et al., (2015)'s survey on the actual cost of the health care services reported that burn care is second expensive care after intensive care among non-surgical wards (Yundendorj et al., 2015).

People often pay from their pocket for medicines. A survey by the MoH and WHO estimated that 70.6% of household spending on health relates to medicines since SHI does not cover the full cost of medical services and medicine patients are required to share costs.

Dashzeveg et al., (2011) reviewed health financing in Mongolia with a focus on social health insurance. They reported people often pay from their pocket for medicines. In addition to they noted that noted that households are facing catastrophic health expenditure while health insurance coverage is 80% of the population. Thus, many low-income households are thus challenged by a considerable financial burden (Dashzeveg et al., 2011).

Mongolia has very large land as 1.56 million km square and the population is only 3.1 million who are live in very scarcely in the countryside. Even though 40% of the population live in Capital city, for patients who live in countryside spend a lot of cost for their transportation from their province to Ulaanbaatar. Therefore, we considered location can be one of major factor which influences the total cost.

III. Methods

A. Study subject

The total number of the 116 inpatients who hospitalized at National Traumatology and Orthopedic Reseach Center participated in this study between the August 1st, 2016 and August 31st, 2016. 3 inpatients were excluded from the study who did not complete research questionnaires. Then a total number of inpatients who completed this study counted as n=113. All burn inpatients had same 3rd degree of burn but different by %TBSA and thickness. We did not include inpatients who have a 4th degree of burn because they had difficulties to complete this study. 1st and 2nd degree burn patients also did not participate in our study because usually, they treated in ambulatory care. In our case, we had 66 inpatients were children (age ≤11) 47 adults (age 20≤). We only studied costs which paid by those patients during a stay in NTORC.

We also studied about inpatient's characteristics which can impact on economic burden caused by burn injury. Those characteristics provide demographic information through variables such as age, gender, household income, education, employment status, number of families, living area (urban, rural), insurance status. And other variables such as place when to get burned, burn reason, surgery status, health status, ICD can provide burn injury information. In addition, we asked from inpatients to make self-evaluation on their economic burden using variables as financial impact degree, financial support status.

Research hypothesis:

Based on the literature review we defined following hypothesis in our study such as:

- Hypothesis 1: %TBSA, LOS are highly significant variables in total cost of burn treatment.

- Hypothesis 2: fire or flame burns were in general higher than costs of other burns
- Hypothesis 3: medical cost of burn care is high in low-income level households comparing to high-income level households

B. Data collection

The quantitative and qualitative research methods were used to collect the research information and data. There were inpatients who already have started their treatments before we conduct our study. Information and some secondary information possibly obtained those patients prospectively. Our research questionnaire has 2 parts (first part information filled by inpatients and second part information filled by the hospital) and 3 main sections with cost tables. The cost table provided detailed information on costs. Inpatient's information such ICD, the degree of burn, %TBSA burned filled by the hospital (medical doctors and nurses). Our secondary resources of information collected from theoretical textbooks, international journals and articles, websites, medical records and some statistical data which refer to NTORC.

The permission to start this research work was received during the discussion in the National Trauma and Orthopedic Research Center in August 1st of 2016. The research work was conducted by presenting it to the participants and explaining the use of the information just for the scientific purposes including the requests for the independent participation where the permission was signed and confirmed.

C. Statistical analysis

The SPSS 20 program was used in the digital information inclusions, testing, and processions. Also, the method of the summative approach was used in the framework of the quality or questionnaire researches. Descriptive statistics will be used to analyze quantitative information and summarization of data. Inferential statistics will be used to test the

hypothesis. Correlation analysis used to detect relationship between variables. Based on the cost data, we created two cost groups such as high cost (above mean of total OOP) and low cost (below mean of total OOP). Then we used them for logistic regression analysis. Multiple linear regression analysis used to detect a relationship between total out-of-pocket cost and other independent variables. Also, we used Ms. Excel program for some graphical or figure analysis using primary data.

We compared mean, standard deviation and statistical significance among our categorical variables. In order to test the statistical significance of those categorical variables, we used a t-test for 2 levels variable and ANOVA used to test the significance of 3 or more levels variables.

We created cost groups as low-cost and high-cost in order to predict the total cost of the burn patient. This cost groups used as a binary variable in logistic regression analysis in further results (see pages 48-51).

IV. Results

A. Descriptive analysis

We show our study results of descriptive analysis by figures and each of them described in this section. As a result, there are not many statistically significant categorical variables found. Only insurance was significant (p=0.02) among adult patients (see Table 5.1 and 5.2).

We have 66 people are age between 0-19 years and they were 52% of the survey population. There were 19 people in age between 20 and 29 years and 19 people in age between 30-39 years. There were only 13 people in age between 40 and overs. When we looked at the location of survey participants, 89 people or 78% are live in Ulaanbaatar and 24 people or 22% are live in the rural area (see Figure 2).

In totally, 113 people are covered in this survey. 52 of them are females and 61 are males. There are 24 male patients and 23 female patients in adult patients, whereas 37 male patients and 27 female patients in child patients (see Table 6.1 and 6.2). Gender is not statistically significant variable (p=0.13) in t-test analysis (see Table 5.1 and 5.2). Although, female patients have a higher cost than male patients in adult patients in contrast to child patients (see Table 5.1 and 5.2). Probably, these differences related to %TBSA burned between adult patients and child patients. For adult patients, male patient's mean of total %TBSA burned was 11.83% whereas female patient's mean of total %TBSA burned was 12.74%. For child patients, male patient's mean of total %TBSA burned was 12.14% whereas female patient's mean of total %TBSA burned was 9.90%. In addition, child patient who has female caregiver have a higher cost than child patient who has a male caregiver (see Table 5.1 and 5.2).

Moreover, it can be seen from the table male patients who earn more than 700 000 MNT are 16 or 26% of all males, conversely, female patients who earn more than 700 000 MNT are 17 or 32.7% of all female participants. It can be seen that 29 (25%) patients of the total

population are in lower secondary and uneducated levels of education. Moreover, 84 (75%) patients are over secondary and educated people covered in this survey. If the patient is a child, education level defined from adult or person who is caring the child during his/her treatment (see Figure 4)

One of our socioeconomic independent variables is education. Education is not statistically significant (p=0.14) in ANOVA test. There are three levels of educations such as low, middle, high. Low educated patients have less costs than higher educated patients and middle educated patients have the highest costs among adult patients (see Table 5.1). However, patients who have middle-educated caregivers have lowest costs among child patients. Same as adult patients, caregiver's education is not statistically significant (p=0.32) (see Table 5.2). In addition, there are more middle educated patients (n=15) in the high-cost group among adult patients but there are more high educated caregivers (n=31) among child patients (see Table 6.1 and Table 6.2).

Employment is also another socioeconomic variable. Employed patients and patients who have employed caregivers have higher costs compared to unemployed patients and unemployed caregivers (see Table 5.1 and Table 5.2). In other words, employed people spend more than unemployed people for burn care.

According to household income levels, patients have high costs compared to household income levels. Household income is not statistically significant (p=0.66 in adult patients and p=0.91 in child patients) variable in ANOVA test (Table 5.1 and Table 5.2). And low-income households have less costs compared with two middle- and high-income households. In comparison with child patients, adult patients have more cost difference in household income levels (Table 5.1 and Table 5.2). In addition, we have more low- and middle-income households in our study (Table 6.1 and 6.2).

There are not much cost difference among adult patients related to number of family members. Although, child patients who have 4 members in their family spend more money than other levels (3 or less and 5 or more members family). According to low- and high-cost group, 3 or less members family have more difference (13 patients=15-2) than other levels (4 and 5 or more members family) (see Table 6.2).

Location has two levels such as urban and rural. T-test result shows that location is not significant variable (p=0.06 in adult patients and p=016 in child patients). However, rural area patients spend almost two times higher than urban patients (1011973 MNT vs. 562475 MNT) among adult patients (see Table 5.1). But we have almost three times higher urban patients than rural patients (36 patients vs. 11patients) among adult patients.

58 people who live in UB are employed and there are only 7 persons live rural area who are employed. In total, 65 people (57,5%) are employed and 48 people (42,5%) are unemployed. For the income, 43 people or 38% have income less than 500 000 MNT and 37 people or 32.7% have income between 500 001 MNT and 700 000 MNT. There are 50 male patients who are live in UB and 16 of them earn an income more than 700 000 MNT which is almost same for female patients (see Figure 3).

Another socioeconomic variable is the type of living place. We categorized this variable into two types such as apartment and house or ger based on their heating system. Type of living place is not statistically significant (p=0.13 and 0.78 in adult and child patients). Patients who live in house or ger spend more money for burn care compared to patients who live in an apartment (see Table 5.1 and 5.2). We also checked percent of total body surface area burned for both adult and child patients. As a result, adult patients who live in an apartment have 11.47% mean of %TBSA burned and adult patients who live in house or ger have 12.66% mean of %TBSA burned. Child patients who live in an apartment have 8.94%

mean of TBSA and child patients who live in a house or ger have 13.24% mean of %TBSA burned. We can see from these results, patients who live in an apartment have less %TBSA burned than patients who live in house or ger.

Ownership variable is not statistically significant in t-test analysis. As shown in Table 5.1-5.2, patients who own their living place (apartment, house or ger) spend more money for burn care compared with patients who pay (or rent) for their living place (see Table 5.1 and 5.2).

As shown in Table 5.1-5.2, patients who had surgery spend more money for burn care than patients who did not have surgery. Surgery is not statistically significant ($p=0.45$, $p=0.60$ in adult and child patients) variable in t-test analysis (see Table 5.1 and Table 5.2).

The place when get burned is not a significant variable in t-test analysis. Adult patients who burned at other place have more cost than adult patients who burned at their home. However, child patients have more cost who burned at home than child patients who burned at another place.

Among adult patients, hot drink, meal, cooking caused burn costs more than other causes. But hot stream, air or gas, household appliance caused burn costs more than other causes among child patients (see Table 5.1 and 5.2). Most of the patients who included in the high cost group have a hot drink, meal, cooking oil caused burns (see Table 6.1 and 6.2).

91 patients are insured and 71 of them live in UB, conversely, 22 patients are not insured and 18 of them live in UB. Patients live in rural are not likely to be insured and in totally and 4 people who live in rural were not insured (see Figure 5). For financial impact, there are 89 people who considered themselves as having more financial impacts than averages. There are only 4 people who considered themselves as having a low financial impact. Thus, we can say that most patients considered themselves as the financial impact of their treatment. 44

patients (39%) spent more money for their treatment and 69 people or 61% were spent less money for their treatment than average.

It can be understood that patients spending around 536.9 thous. MNT on average for their treatment. Also, patients live in UB were spent slightly less cost as 504.4 thous. MNT, conversely, people who live in the rural area spent 657.1 thous. MNT for their treatment. Transportation cost would be the reason for people live in the rural area (see Figure 6).

The mean of the burn area is 12% and male patients had slightly bigger burn area than female patients. Moreover, patients who live in UB had 11% burn area which is less than people who live in the rural area had 15% burn area (see Figure 7). The average length of stay in hospital was 8 days and there was not any difference between males and females as well as location.

Table 5.1. Total Medical Cost of Burn Patient by Demographic and Burn Characteristics of Adult Patients.

Variable	*Mean (SD), MNT*	*P-value*
Inpatient's gender		0.13
Male	572883.33 (290006.13)	
Female	766591.30 (539159.24)	
Inpatient's education		0.14
Low	505962.50 (228625.60)	
Middle	805864.71 (413111.53)	
High	684692.86 (588909.20)	
Inpatient's employment		0.38
Employed	708770.00 (529967.44)	
Unemployed	607221.05 (243855.77)	
Household income levels		0.66
500000 or less	627190.00 (273594.73)	
500001-700000	762484.62 (501152.74)	
700001 or more	637478.57 (566489.61)	
Number of family members		0.88
3 or less	671140.00 (316791.91)	
4	619685.71 (511846.22)	
5 or more	695382.61 (447785.24)	
Location		0.06
Urban	562475.00 (259419.64)	
Rural	1011972.73 (701670.94)	

Table 5.1. Total Medical Cost of Burn Patient by Demographic and Burn Characteristics of Adult Patients (cont'd)

Variable	*Mean (SD), MNT*	*P-value*
Type of living place		0.13
Apartment	525720.00 (287927.18)	
House or ger	734218.75 (480782.91)	
Ownership		0.69
Own	674334.09 (450067.66)	
Rent	570033.33 (121742.36)	
Surgery		0.45
Yes	738600.00 (478949.21)	
No	634431.25 (419215.90)	
Place when to get burned		0.59
At home	639865.52 (327132.87)	
Other	712483.33 (456312.97)	
Reason of burn		0.39
Electrical, fire or flames	628147.06 (496817.32)	
Hot water, tea, meal, cooking oil	787168.75 (517470.57)	
Hot stream, air, gas, household appliances	579114.29 (183892.49)	
Health status		0.46
Healed	439250.00 (170766.29)	
Improved	677828.89 (442928.20)	

Table 5.1. Total Medical Cost of Burn Care by Demographic and Burn Characteristics of Adult Patients (cont'd)

Variable	*Mean (SD), MNT*	*P-value*
Insurance		0.02
Insured	782974.07 (535016.97)	
Uninsured	512025.00 (159690.29)	
Financial support		0.66
Received	726177.78 (306373.82)	
Not received	653821.05 (464446.72)	
Degree of financial impact		0.91
Low	728587.50 (768930.06)	
Middle	665418.75 (178202.87)	
High	648060.87 (432570.72)	
ICD		0.33
T-21	942700.00 (536675.53)	
T-22	329600.00 (181483.84)	
T-23	642183.33 (272291.06)	
T-24	628375.00 (327474.49)	
T-29	614490.91 (305667.51)	

Table 5.2. Total Medical Cost of Burn Patient by Demographic and Burn Characteristics of Child Patients

Variable	*Mean (SD), MNT*	*P-value*
Inpatient's gender		0.28
Male	473194.60 (288830.77)	
Female	406241.38 (183308.59)	
Caregiver's gender		0.33
Male	398075.00 (187054.55)	
Female	463645.65 (270482.69)	
Caregiver's education		0.32
Low	535753.85 (389948.05)	
Middle	397872.73 (231339.29)	
High	427328.57 (192072.12)	
Caregiver's employment		0.90
Employed	447327.78 (211593.85)	
Unemployed	439513.33 (290597.08)	
Household income levels		0.91
500000 or less	429556.52 (333645.53)	
500001-700000	441658.33 (171609.27)	
700001 or more	463663.16 (220898.29)	
Number of family members		0.34
3 or less	392811.77 (168660.84)	
4	503752.17 (332403.27)	
5 or more	424042.31 (199398.17)	

Table 5.2. Total Medical Cost of Burn Patient by Demographic and Burn Characteristics of Child Patients (cont'd)

Variable	*Mean (SD), MNT*	*P-value*
Health status		0.15
Healed	267550.00 (232048.22)	
Improved	455145.16 (247054.63)	
Insurance		0.63
Insured	446417.19 (250331.53)	
Uninsured	359250.00 (232991.68)	
Financial support		0.17
Received	248400.00 (92457.99)	
Not received	453079.37 (250158.21)	
Degree of financial impact		0.89
Low	436100.00 (236907.46)	
Middle	432400.00 (293423.71)	
High	465333.33 (193637.54)	
ICD		0.22
T-21	381255.56 (102152.22)	
T-22	582250.00 (179958.68)	
T-23	349109.09 (202100.19)	
T-24	559925.00 (408215.42)	
T-25	503666.67 (143841.35)	
T-29	434506.25 (167827.90)	

Table 6.1. Low-Cost vs. High-Cost Group of Adult Patients (n,%)

Variable	Low-cost group N (%)	High-cost group N (%)	Total N (%)
Inpatient's gender			
Male	12 (50.0)	12 (50.0)	24 (100.0)
Female	9 (39.1)	14 (60.9)	23 (100.0)
Inpatient's education			
Low	10 (62.5)	6 (37.5)	16 (100.0)
Middle	2 (11.8)	15 (88.2)	17 (100.0)
High	9 (64.3)	5 (35.7)	14 (100.0)
Inpatient's employment			
Employed	14 (50.0)	14 (50.0)	28 (100.0)
Unemployed	7 (36.8)	12 (63.2)	19 (100.0)
Household income levels			
500000 or less	8 (40.0)	12 (60.0)	20 (100.0)
500001-700000	4 (30.8)	9 (69.2)	13 (100.0)
700001 or more	9 (64.3)	5 (35.7)	14 (100.0)
Number of family members			
3 or less	3 (30.0)	7 (70.0)	10 (100.0)
4	9 (64.3)	5 (35.7)	14 (100.0)
5 or more	9 (39.1)	14 (60.9)	23 (100.0)

Table 6.1. Low-Cost vs. High-Cost Group of Adult Patients (n,%) (cont'd)

Variable	Low-cost group N (%)	High-cost group N (%)	Total N (%)
Location			
Urban	18 (50.0)	18 (50.0)	36 (100.0)
Rural	3 (27.3)	8 (72.7)	11 (100.0)
Type of living place			
Apartment	9 (66.0)	6 (34.0)	15 (100.0)
House or ger	12 (37.5)	20 (62.5)	32 (100.0)
Ownership			
Own	20 (45.5)	24 (54.5)	44 (100.0)
Rent	1 (33.3)	2 (66.7)	3 (100.0)
Surgery			
Yes	5 (33.3)	10 (66.7)	15 (100.0)
No	16 (50.0)	16 (50.0)	32 (100.0)
Place when to get burned			
At home	14 (48.3)	15 (51.7)	29 (100.0)
Other	7 (38.9)	11 (61.1)	18 (100.0)

Table 6.1. Low-Cost vs. High-Cost Group of Adult Patients (n,%) (cont'd)

Variable	Low-cost group N (%)	High-cost group N (%)	Total N (%)
Reason of burn			
Electrical, fire or flames	11 (64.7)	6 (35.3)	17 (100.0)
Hot water, tea, meal, cooking oil	4 (25.0)	12 (75.0)	16 (100.0)
Hot stream, air, gas, household appliances	6 (42.9)	8 (57.1)	14 (100.0)
Health status			
Healed	1 (66.7)	1 (33.3)	2 (100.0)
Improved	20 (44.4)	25 (55.6)	45 (100.0)
Insurance			
Insured	10 (37.0)	17 (63.0)	27 (100.0)
Uninsured	11 (55.0)	9 (45.0)	20 (100.0)
Financial support			
Received	3 (33.3)	6 (66.7)	9 (100.0)
Not received	18 (47.4)	20 (52.6)	38 (100.0)

Table 6.1. Low-Cost vs. High-Cost Group of Adult Patients (n,%) (cont'd)

Variable	Low-cost group N (%)	High-cost group N (%)	Total N (%)
Degree of financial impact			
Low	4 (50.0)	4 (50.0)	8 (100.0)
Middle	4 (25.0)	12 (75.0)	16 (100.0)
High	13 (56.5)	10 (43.5)	23 (100.0)
ICD			
T-21	5 (62.5)	3 (37.5)	8 (100.0)
T-22	2 (100)	0 (0.0)	2 (100.0)
T-23	2 (33.3)	4 (66.7)	6 (100.0)
T-24	8 (40.0)	12 (60.0)	20 (100.0)
T-29	4 (36.4)	7 (63.6)	11 (100.0)

Variable	Low-cost group Mean	SD	High-cost group Mean	SD
Percent of total body surface area burned	9.62	3.38	14.42	8.65
Length of stay days	6.95	1.99	8.42	2.34

Table 6.2. Low-Cost vs. High-Cost Group of Child Patients (n,%)

Variable	Low-cost group		High-cost group		Total	
Inpatient's gender						
Male	26	(70.3)	11	(29.7)	37	(100.0)
Female	22	(75.9)	7	(24.1)	29	(100.0)
Caregiver's gender						
Male	16	(80.0)	4	(20.0)	20	(100.0)
Female	32	(69.6)	14	(30.4)	47	(100.0)
Caregiver's education						
Low	9	(69.2)	4	(30.8)	13	(100.0)
Middle	8	(72.7)	3	(27.3)	11	(100.0)
High	31	(73.8)	11	(26.2)	42	(100.0)
Caregiver's employment						
Employed	24	(66.7)	12	(33.3)	36	(100.0)
Unemployed	24	(80.0)	6	(20.0)	30	(100.0)
Household income levels						
500000 or less	19	(82.6)	4	(17.4)	23	(100.0)
500001-700000	17	(70.8)	7	(29.2)	24	(100.0)
700001 or more	12	(63.2)	7	(36.8)	19	(100.0)
Number of family members						
3 or less	15	(88.2)	2	(11.8)	17	(100.0)
4	15	(65.2)	8	(34.8)	23	(100.0)
5 or more	18	(69.2)	8	(30.8)	26	(100.0)

Table 6.2. Low-Cost vs. High-Cost Group of Child Patients (n,%) (cont'd)

Variable	Low-cost group		High-cost group		Total	
Location						
Urban	36	(67.9)	17	(32.1)	53	(100.0)
Rural	12	(92.3)	1	(7.7)	13	(100.0)
Type of living place						
Apartment	22	(68.8)	10	(31.2)	32	(100.0)
House or ger	26	(76.5)	8	(23.5)	34	(100.0)
Ownership						
Own	46	(71.9)	18	(28.1)	64	(100.0)
Rent	2	(100)	0	(0.0)	2	(100.0)
Surgery						
Yes	17	(65.4)	9	(34.6)	26	(100.0)
No	31	(77.5)	9	(22.5)	40	(100.0)
Place when to get burned						
At home	46	(71.9)	18	(28.1)	64	(100.0)
Other	2	(100.0)	0	(0.0)	2	(100.0)

Table 6.2. Low-Cost vs. High-Cost Group of Child Patients (n,%) (cont'd)

Variable	Low-cost group		High-cost group		Total	
Reason of burn						
Electrical, fire or flames	8	(80.0)	2	(20.0)	10	(100.0)
Hot water, tea, meal, cooking oil	35	(74.5)	12	(25.5)	47	(100.0)
Hot stream, air, gas, household appliances	5	(55.6)	4	(44.4)	9	(100.0)
Health status						
Healed	3	(75.0)	1	(25.0)	4	(100.0)
Improved	45	(72.6)	17	(27.4)	62	(100.0)
Insurance						
Insured	46	(71.9)	18	(28.1)	64	(100.0)
Uninsured	2	(100.0)	0	(0.0)	2	(100.0)
Financial support						
Received	3	(100.0)	0	(0.0)	3	(100.0)
Not received	45	(71.4)	18	(28.6)	63	(100.0)

Table 6.2. Low-Cost vs. High-Cost Group of Child Patients (n,%) (cont'd)

Variable	Low-cost group		High-cost group		Total	
Degree of financial impact						
Low	12	(75.0)	4	(25.0)	16	(100.0)
Middle	22	(75.9)	7	(24.1)	29	(100.0)
High	14	(66.7)	7	(33.3)	21	(100.0)
ICD						
T-21	17	(94.4)	1	(5.6)	18	(100.0)
T-22	1	(50.0)	1	(50.0)	2	(100.0)
T-23	9	(81.8)	2	(18.2)	11	(100.0)
T-24	9	(56.2)	7	(43.8)	16	(100.0)
T-25	1	(33.3)	2	(66.7)	3	(100.0)
T-29	11	(68.8)	5	(31.2)	16	(100.0)

Variable	Low-cost group		High-cost group	
	Mean	SD	Mean	SD
Percent of total body surface area burned	10.10	7.50	13.94	8.93
Length of stay days	7.33	1.79	8.33	2.06

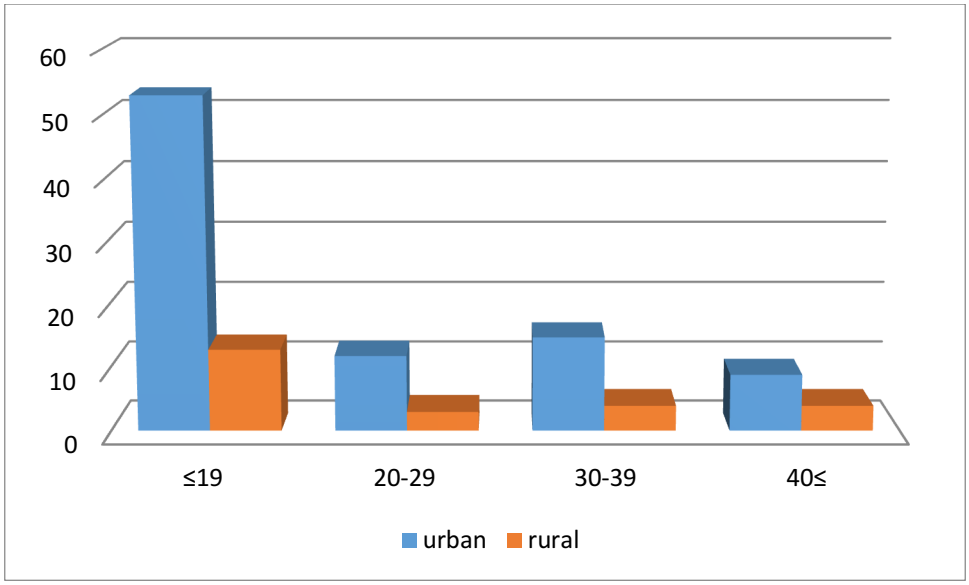

Figure 2. Total Medical Cost of Burn Care Comparison of Urban and Rural Burn Patients by Age-Groups

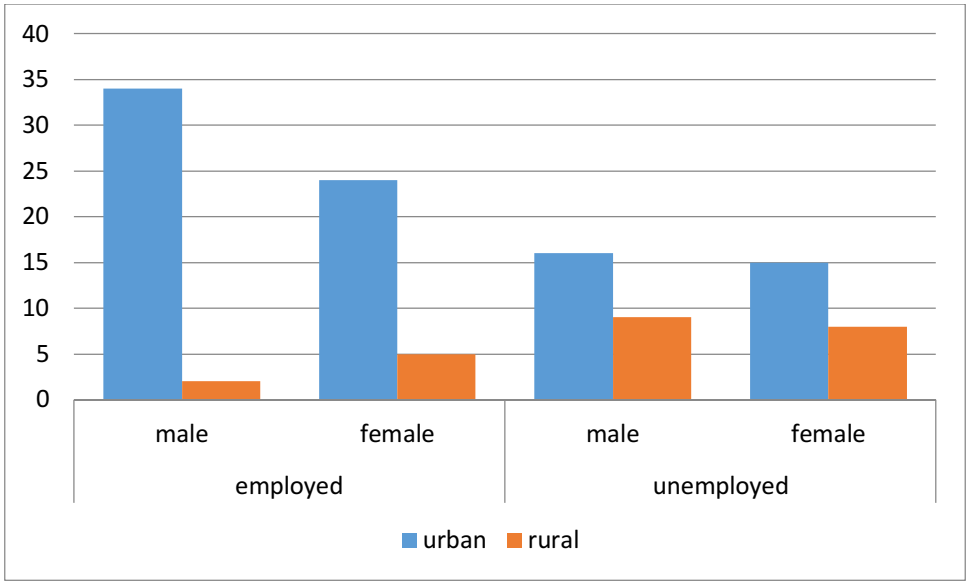

Figure 3. Total Medical Cost of Burn Care Comparison of Urban and Rural Burn Patients by Gender and Employment Status

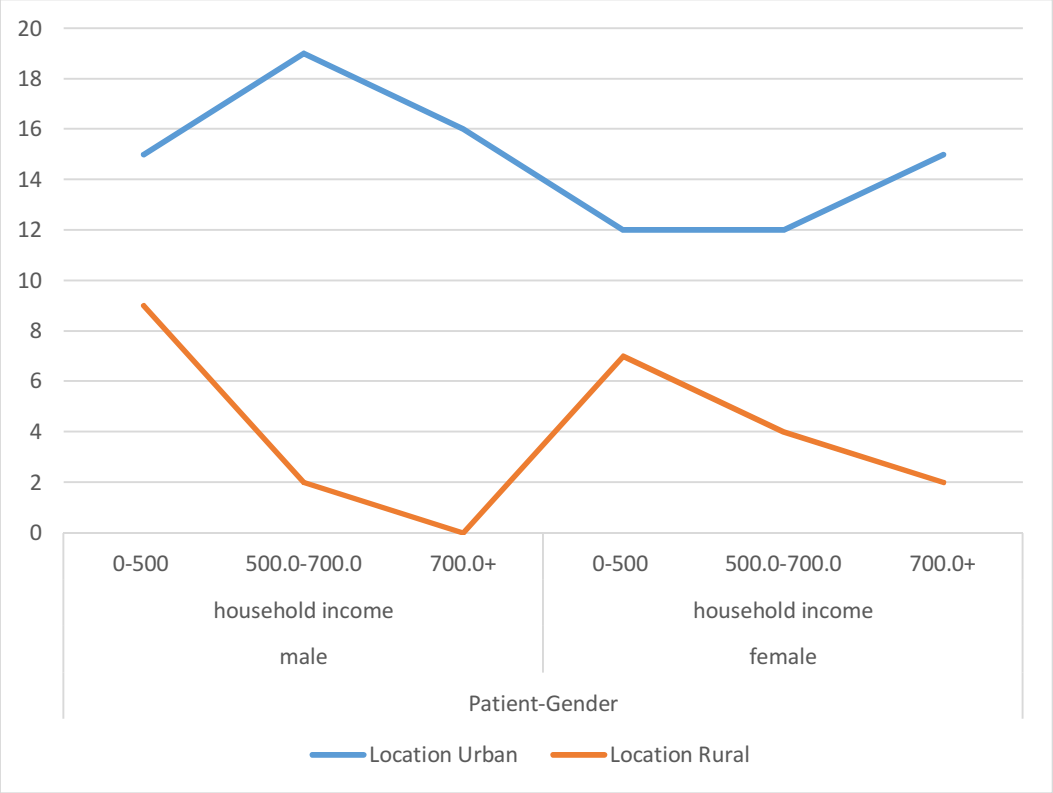

Figure 4. Total Medical Cost of Burn Care Comparison of Urban and Rural Burn Patients by Gender and Household Income Levels

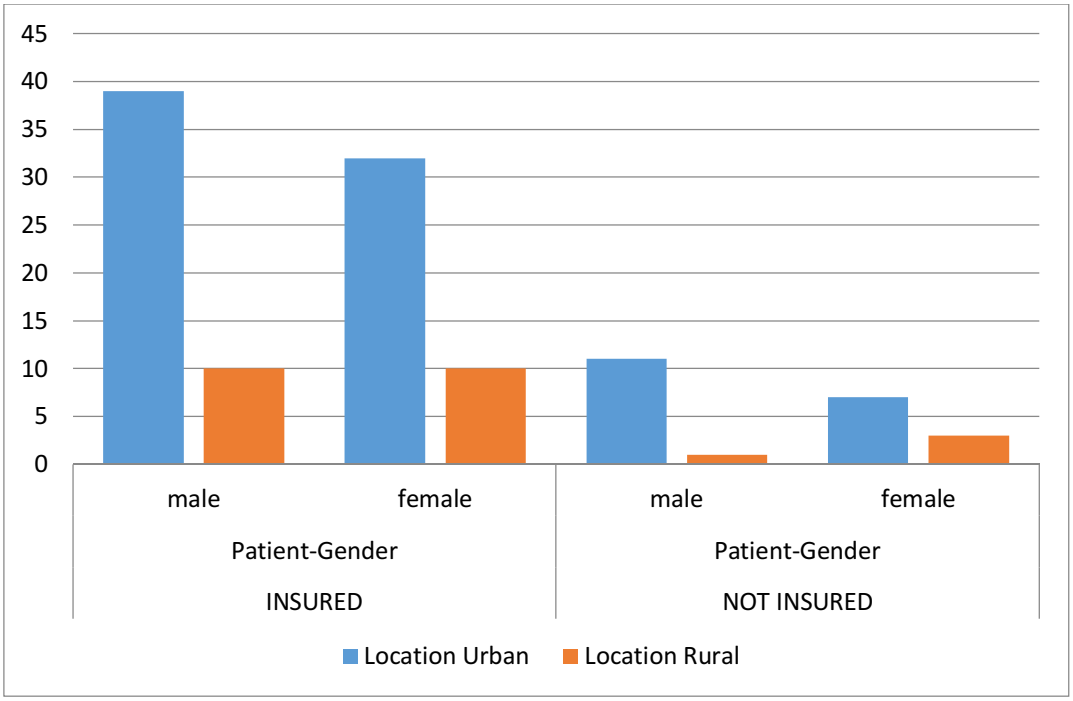

Figure 5. Total Medical Cost of Burn Care Comparison of Urban and Rural Burn Patients by Gender and Insurance Status

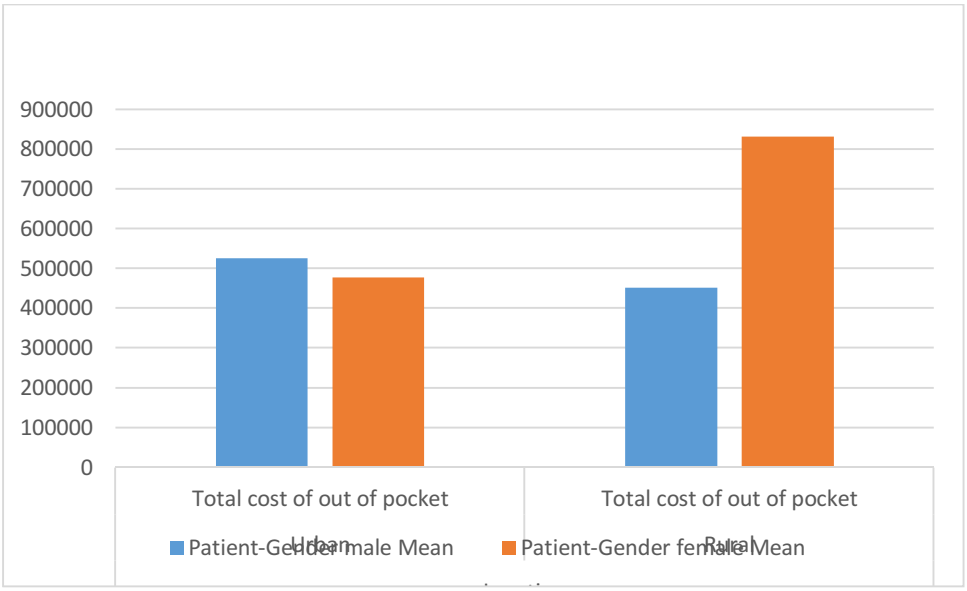

Figure 6. Urban vs. Rural Burn Patients by Gender and Mean of Total Cost of Burn Patient

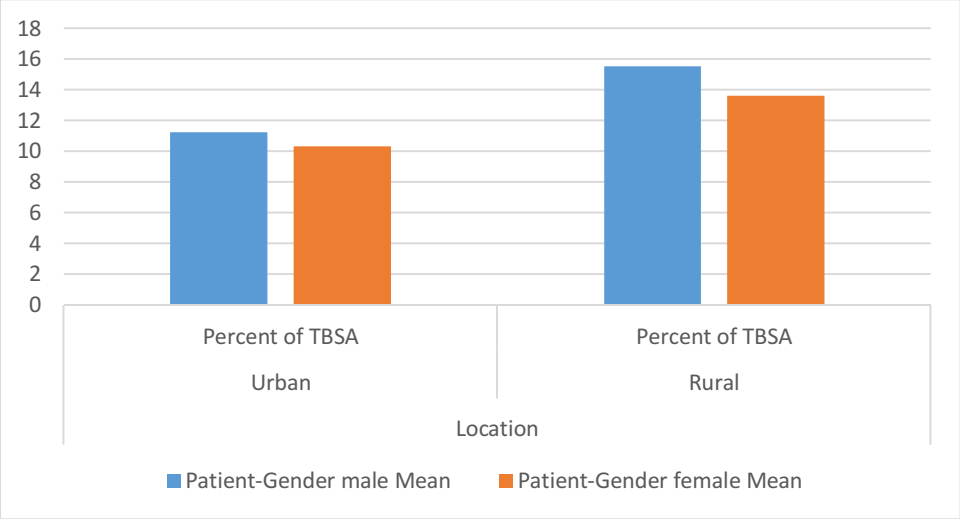

Figure 7. Urban vs. Rural Burn Patients by Gender and Mean of Percent of Total Body Surface Area

B. Multiple linear regression

A multiple linear regression was calculated to predict the total cost of burn inpatient treatment.

Adult patient's multiple linear regression based on patient age, patient employment, location, type of living place, insurance status, household income, patient education, the %TBSA. A significant regression equation was found ($F(10,36)=3.887$, $p<.001$, with an R^2 of .519. The location is coded as 1=Urban, 0=Rural. Inpatient who lives in the rural area spends 461327 MNT more than inpatient who lives in the urban area. Also, insured patients spend 261973 MNT more than the uninsured patient. The employed patient pays 433732 MNT more than the unemployed patient. Both inpatient's employment, location, insurance were significant predictors of the total cost of burn inpatient treatment. The total cost of burn inpatient treatment for the adult patient will increase 16284 MNT if the %TBSA burned increase by 1 percent. That predictor variable explains 51.9% of total cost of burn inpatient's treatment (Table 7.1).

Child patient's multiple linear regression based on location, type of living place, insurance status, education of caregiver, household income, and %TBSA. A significant regression equation was found ($F(8,57)=1.794$, $p<.097$, with an R^2 of .201. The location is coded as 1=Urban, 0=Rural, and %TBSA is measured in percentage. Inpatient who lives in the urban area spent 127801 MNT more than inpatients who live in rural area. Also, insured patients spend 65951 MNT more than the uninsured patient. The only %TBSA was a significant predictor of the total cost of burn inpatient treatment. The total cost of burn inpatient treatment for child patient will increase 10955 MNT if the %TBSA burned increase by 1 percent. That predictor variable explains 20.1% of total cost of burn inpatient's treatment (Table 7.2).

Table 7.1. Multiple Linear Regression Model Associated with the Total Medical Cost of Adult Patient.

Variable	*Coefficient*	*SE*	*t*	*P-value*
(Constant)	201071.10	381541.96	0.53	0.60
Inpatient's age	4307.427	5925.30	0.73	0.47
Inpatient's employment				
Employed	433732.54	190553.94	2.28	0.03
Unemployed	(ref)			
Location				
Urban	-461327.19	148977.14	-3.10	<0.01
Rural	(ref)			
Type of living place				
Apartment	-190206.65	129341.99	-1.47	0.15
House or ger	(ref)			
Insurance				
Insured	261973.40	114862.27	2.28	0.03
Uninsured	(ref)			

Table 7.1. Multiple Linear Regression Model Associated with the Total Medical Cost of Adult Patient.

Variable	*Coefficient*	*SE*	*t*	*P-value*
Household income				
500000 or less	132931.70	179035.93	0.74	0.46
500001 - 700000	145.64	174743.91	0.001	1.00
700001 or more	(ref)			
Patient education				
Low	-29073.63	191297.21	-0.15	0.88
Middle	180341.45	164304.38	1.10	0.28
High	(ref)			
Percent of total body surface area burned	16284.11	9134.13	1.78	0.08

Table 7.2. Multiple Linear Regression Model Associated with the Total Medical Cost of Child Patient.

Variable	*Coefficient*	*SE*	*t*	*P-value*
(Constant)	181735.52	200882.91	0.91	0.37
Location				
Urban	127800.74	85073.69	1.50	0.14
Rural	(ref)			
Type of living place				
Apartment	-30601.42	81260.85	-0.38	0.71
House or ger	(ref)			
Insurance				
Insured	65951.68	174144.75	0.38	0.71
Uninsured	(ref)			
Caregiver's education				
Low	155743.68	100179.09	1.56	0.13
Middle	29787.21	127539.52	0.23	0.82
High	(ref)			
Household income				
500000 or less	-111979.50	119760.51	-0.94	0.35
500001 - 700000	-23343.28	78560.56	-0.30	0.77
700001 or more	(ref)			
Percent of total body surface area burned	10955.16	3879.29	2.82	<0.01

C. Logistic regression

A logistic regression analysis was conducted to predict whether high-cost or low-cost for 113 burn patients using household income, location, type of living place and insurance for both adults and children. Other independent variables such as inpatient's age, inpatient's education selected for the adult patient but caregiver's education is only related to children.

For adult patient's, a test of full model against a constant-only model was statistically significant, indicating that the predictors as a set reliably distinguished between high-cost and low-cost (chi-square = 21.11, p<.012 with df =9).

Nagelkerke's R^2 of .484 indicated a weak relationship between prediction and grouping. Prediction success overall was 85.1% (81.08% for low-cost , 88.5% for high-cost). The Wald criterion demonstrated that only middle education made a significant contribution to prediction (p=.03). Exp (B) value indicates that when middle education is raised by one unit the odd ratio is 16 times as large and therefore adult inpatients are 16 more times likely to show high-cost in our study.

Following results are estimated for those cost groups who spent above and below than mean of burn patient cost of an adult patient (Table 8.1).

For children, a test of the full model against a constant-only model was statistically not significant, indicating that the predictors as a set reliably distinguished between high-cost and low-cost (chi-square = 10.39, p=.109 with df =6) (Table 8.2).

Nagelkerke's R^2 of .216 indicated a weak relationship between prediction and grouping. Prediction success overall was 75.0% (97.8% for low-cost , 16.7% for high-cost). The Wald criterion demonstrated that only middle education of caregiver made a significant contribution to prediction (p=.05). Exp (B) value indicates that when middle education is

raised by one unit the odd ratio is 33 times as large and therefore children are 33 more times likely to show high-cost in our study.

Following results are estimated for those cost groups who spent above and below than mean of burn patient cost of children.

Table 8.1. Logistic Regression Model Associated with the Total Medical Cost of Adult Patient.

Variable	*OR*	*95% CI*	*P*
Inpatient's age	0.96	0.87-1.07	0.45
Inpatient's education			
Low	0.66	0.06-6.94	0.73
Middle	16.51	1.35-201.53	0.03
High	1.00 (ref)		
Employment status of patient			
Employed	0.53	0.02-13.52	0.70
Unemployed	1.00 (ref)		
Household income levels			
500000 or less	1.75	0.11-27.89	0.69
500001-700000	3.26	0.41-25.85	0.26
700001 or more	1.00 (ref)		
Location			
Urban	0.48	0.05-4.29	0.51
Rural	1.00 (ref)		
Type of living place			
Apartment	0.44	0.07-2.83	0.39
House or ger	1.00 (ref)		
Insurance			
Insured	2.87	0.44-18.57	0.27
Uninsured	1.00 (ref)		
Constant	3.18		0.73

Table 8.2. Logistic Regression Model Associated with the Total Medical Cost of Child Patient.

Variable	*OR*	*95% CI*	*P*
Caregiver's education			
Low	6.74	0.63-72.67	0.12
Middle	32.89	1.03-1053.91	0.05
High	1.00 (ref)		
Household income, MNT			
500000 or less	0.05	0.002-1.10	0.06
500001-700000	0.78	0.17-3.61	0.75
700001 or more	1.00 (ref)		
Location			
Urban	6.17	0.56-68.01	0.14
Rural	1.00 (ref)		
Type of living place			
Apartment	0.90	0.17-4.88	0.90
House or ger	1.00 (ref)		
Constant	0.10		0.12

V. Discussion

Our study objective was to determine the medical cost of burn patients in burn inpatients. The mean total medical cost per burn patient was 536902.65 MNT (241.89 USD) per patient within one-month treatment in NTORC. Accordingly, employed adult patient's mean of medical cost was 708770.00 MNT and unemployed adult patient's mean of medical cost was 607221.05 MNT. The Urban area located adult patient's (n=36) mean of medical cost was 562475.00 MNT, in a rural area (n=11) mean of medical cost was 1011972.3 MNT. And insured adults (n=27) mean of medical cost was 782974.07 MNT, uninsured adults (n=20) 512025.00 MNT.

Determining the cost of burn patient is very difficult and challenging work (Sahin, 2011; Ahn, 2012; Griffiths, 2006). Because burn injury takes long recovery than other types of injuries (WHO, 2011; Mashreky, 2008). Mathews et al., (2017) mentioned that burn expenses difficult to quantify completely because of the complex and individual nature of burn treatment (Mathews et al., 2017). In addition to burning survivors need emotional and practical support after discharge from hospital (WHO, 2011).

The cost of caring for a burns patient is known to be higher than for non-burns patients (Sahin, 2011; Hop, 2014; Mashreky, 2008). Also, burn treatment cost is much higher in high-income countries than low- and middle-income countries. According to Hop et al., (2014)'s systematic review of burn care, the mean of total cost per patient was US$88218 (range of US$704-US$717306) in high-income countries and US$5196 (range of US$102- US$1555) in low- and middle-income countries (Hop et al., 2014). Moreover, in low-income countries (e.g., sub-Saharan Africa and much of Asia), the epidemiology of burns is considerably different from that in high-income countries (Mock et al., 2009). For example, the rate of child injury death from fire and flames is nearly 11 times higher in low-income countries than

in high-income countries (Peck et al., 2013). Our result of mean total medical cost per burn patient 536902.65 MNT (241.89 USD) can not represent the true cost of the burn patient. Because we only studied one-month costs which paid by burn patient. Also, we did not include costs which reimbursed from insurance. Sanchez et al., (2007)'s study mentioned medical costs represent only 10% of total costs. In other words, other 90% of costs include costs of productivity losses and informal care (Sánchez et al., 2007).

As we mentioned before, costs associated with burn injury care are much higher than other injuries. Karimi et al., (2015)'s study result of the cost for average adult burns patient was AU$71506 (US$73532) (Karimi et al., 2015). And Sahin et al., (2011)'s study result of the mean total cost per patient was US$15250 (Sahin et al., 2011). Therefore, some researchers studied about the burden of burn injury. Mashreky et al., (2008) assessed the burden of burn injury costs and burn admission was significantly ($p=0.000$) high in a younger age group in their study results (Mashreky et al., 2008). But in our case, mean total cost of burn patient among adult patients (667677 MNT) was higher than child patients (443776 MNT). Similarly, Hop et al., (2016)'s study results show that adult patients were significantly costly than children. And flame burns were significantly more costly than other types of injuries in their study (Hop et al., 2016). However, it was not found significantly than other types of burns in our case. Costs of burns can make difference by burn depths. Because deeper burn takes longer recovery (Kagan et al., 2013). Klein et al., (2008)'s study conducted to evaluate the potential impact of the urban and rural area on hospital costs of the burn patient. The most rural areas tended to have higher costs in this study (Klein et al., 2008). It is similar to our result of location. In our case, rural adult patient's mean of medical cost was almost two times higher than the urban adult patient. This location was statistically significant variable in our multiple linear regression model. According to our results, the size

of burn surface area, location, employment status, insurance are the most influential predictors. More statistically significant variables found in multiple linear regression model than logistic regression model in our study.

There were a number of limitations in our study. We conducted our study only during one month. Actually, burn injury requires long rehabilitation and support services. Longer term follow-up study (more than a month) could be more beneficial for increasing accuracy and reliability of information. We may not include enough burn patients for logistic regression model and we put many variables in both multiple linear regression and logistic regression models in our study. Hosmer and Lemeshow recommend sample sizes greater than 400 for logistic regression analysis. Moreover, recall bias could be occurred in our study. Because patients filled the questionnaire after they finished their burn inpatient treatment.

Further studies can include more patients in order to satisfy this recommended sample size and reducing unnecessary variables may increase the power of regression models. Follow-up method with a longer period (more than a month) can provide more accurate cost data from patients.

VI. Conclusion

Overall, we conducted our study during one month at NTORC, Mongolia with total n=116 (3 patients excluded) burn patients. Our study objective was to determine the medical cost of burn patients in burn inpatients. The mean total medical cost per burn patient defined as 536902.65 MNT (241.89 USD) per patient. It can not represent the true cost of the burn patient. We studied how much burn patient paid themselves for burn care during stay only one month at NTORC. Sanchez, et al., (2007)'s study mentioned medical costs represent only 10% of total costs (Sanchez, et al., 2007). According to our results, the size of burn surface area, location, employment status, insurance are the most influential predictors. There were more statistically significant variables found in multiple linear regression model than logistic regression model in our study.

Also, our study confirmed some hypothesis as percent total body surface area of burns was statistically significant variables in the cost of burn treatment but only in child patients in this study. And household income level was not a statistically significant variable. Fire and flame related burn injuries were higher than other types of injuries among adult patients but hot drink and meal related burn injuries were higher among child patients.

Further study is needed to continue to examine the costs related to burn injuries. In addition, studies can include more burn patients in order to satisfy Hosmer and Lemeshow's recommended sample size (greater than 400) for better results of logistic regression analysis and reducing unnecessary variables may also increase the power of regression models. Follow-up method with a longer period (more than a month) can provide more accurate cost data from burn patients.

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Appendices

Table S1. Mean of burn inpatient cost by each cost variable

№	Costs	*Mean*	*(SD)*
1	Non-ICU room	95000.00	(9258.20)
2	ICU room		
3	Surgery cost	52000.00	(0.00)
4	Drug cost	67113.19	(137335.75)
5	Fluid cost	72279.17	(42183.58)
6	Dressing cost	67853.10	(50604.83)
7	Oil cost	254254.46	(197033.30)
8	Diagnosis cost	44314.29	(69389.42)
9	Food cost	80253.33	(45530.83)
10	Travel cost	24702.70	(14835.84)
11	Personal consumables cost	24849.21	(27786.87)
12	Medical consumables cost	15401.72	(15903.30)
13	Total cost	536902.65	(355611.44)

Table S2. Total cost calculation for same %TBSA group of burn inpatients

Cost category	Group of %TBSA			
	0-9% (n=55) mean±std deviation	10-19% (n=43) mean±std deviation	20-29% (n=11) mean±std deviation	30%+ (n=4) mean±std deviation
Non ICU room cost	100000.00±0.001	100000.00±	92000.00±10954.45	
ICU room cost				
Surgery cost			52000.00±0.001	
Drug cost	42704.65±34756.92	61600.00±43246.70	178700.00±396403.82	109333.33±78748.55
Fluid cost	69348.94±48761.34	68586.49±26207.59	113712.50±51288.86	58000.00±18956.09
Dressing cost	59050.91±42879.06	67246.51±48262.97	108727.27±79232.68	83000.00±33406.59
Oil cost	20916.36±106111.29	243478.57±128757.55	453227.27±391536.68	431250.00±520966.65
Diagnosis cost	16666.67±10408.33	20066.67±13740.94	200000.00	
Food cost	67843.75±39521.42	88529.41±43129.29	116000.00±80808.42	64500.00±30784.20
Travel cost	21515.15±10977.59	27212.12±17902.09	32000.00±16431.68	20000.00±0.001
Personal consumables	24384.62±28912.39	20517.86±18745.61	29400.00±16712.27	52500.00±65000.00
Medical consumables	12911.54±14486.36	14829.17±13682.66	32240.00±28516.45	13500.00±2598.07

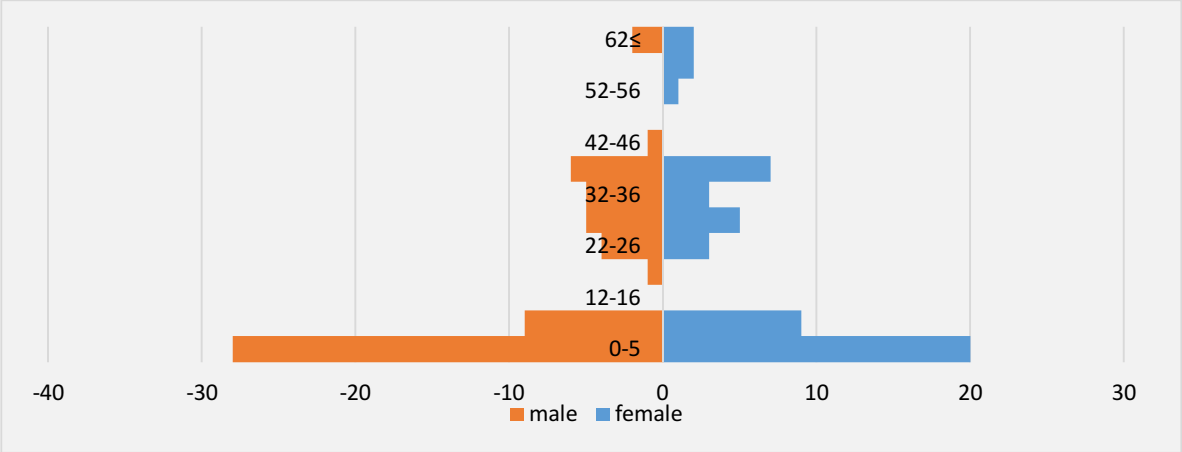

Figure S1. Total Burn Patients by Age and Gender

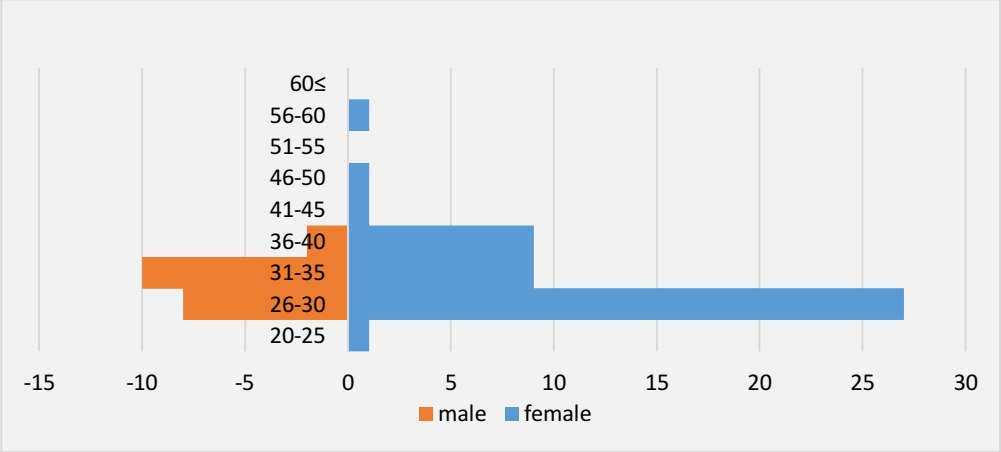

Figure S2. Total Caregivers of Burn Patients by Age and Gender

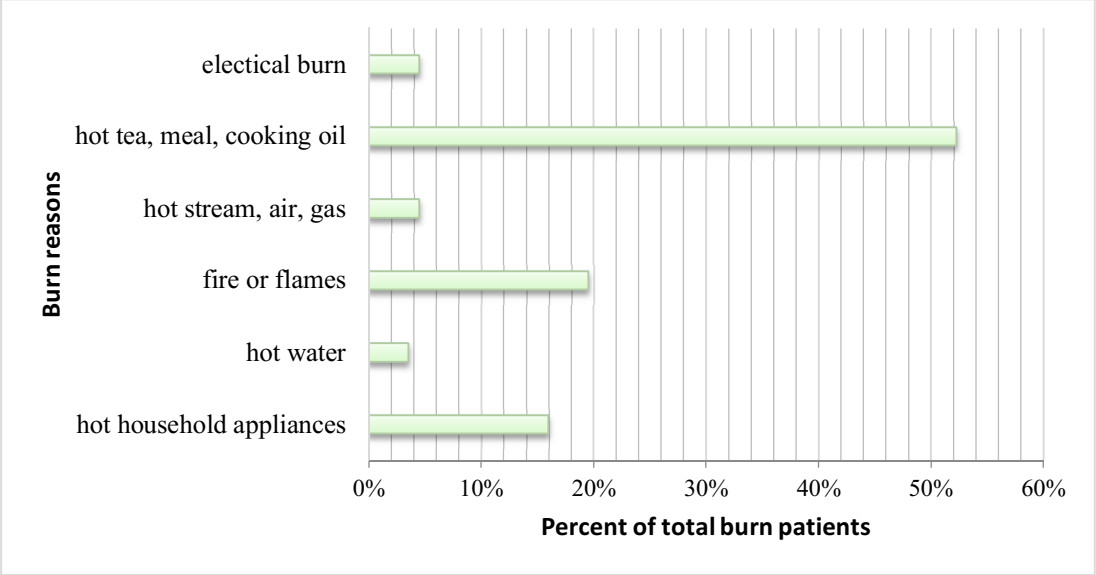

Figure S3. Total Burn Patients by Burn Reason

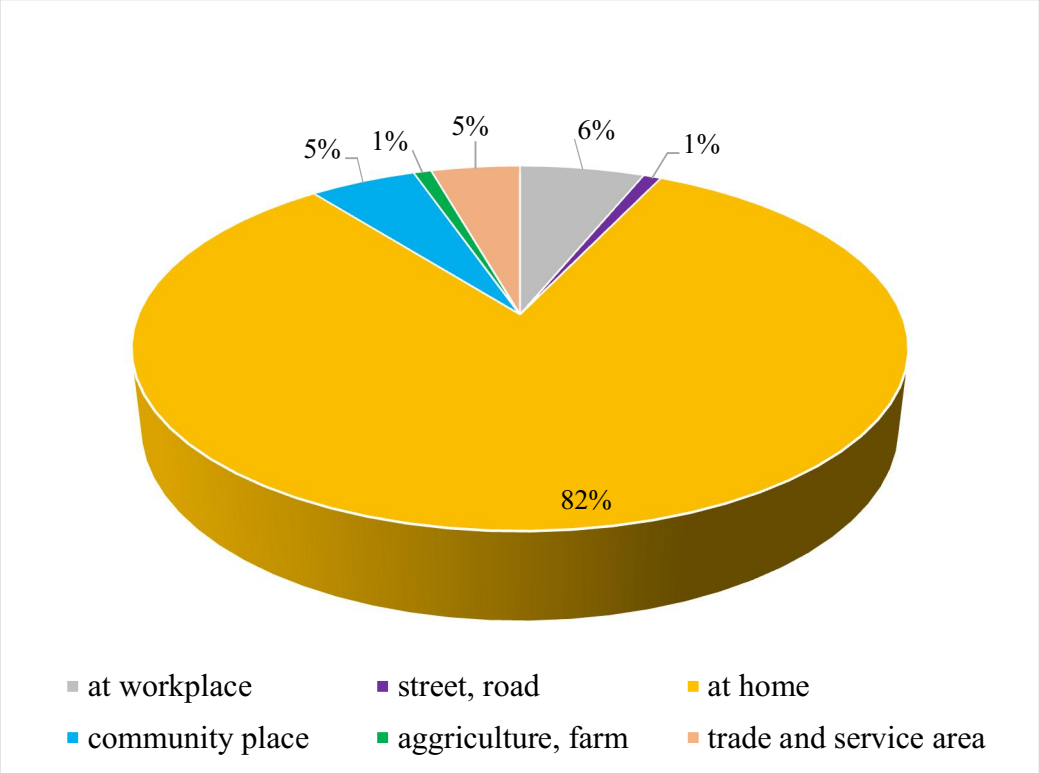

Figure S4. Total Burn Patients by Place Where Burn Injuries Cccurred

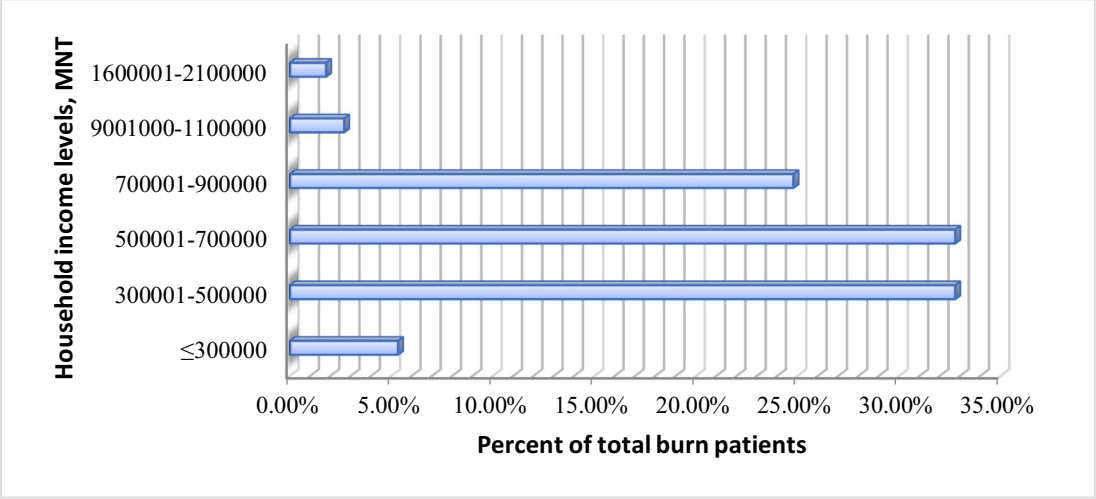

Figure S5. Total Burn Patients by Household Income Levels of Total Burn Patients

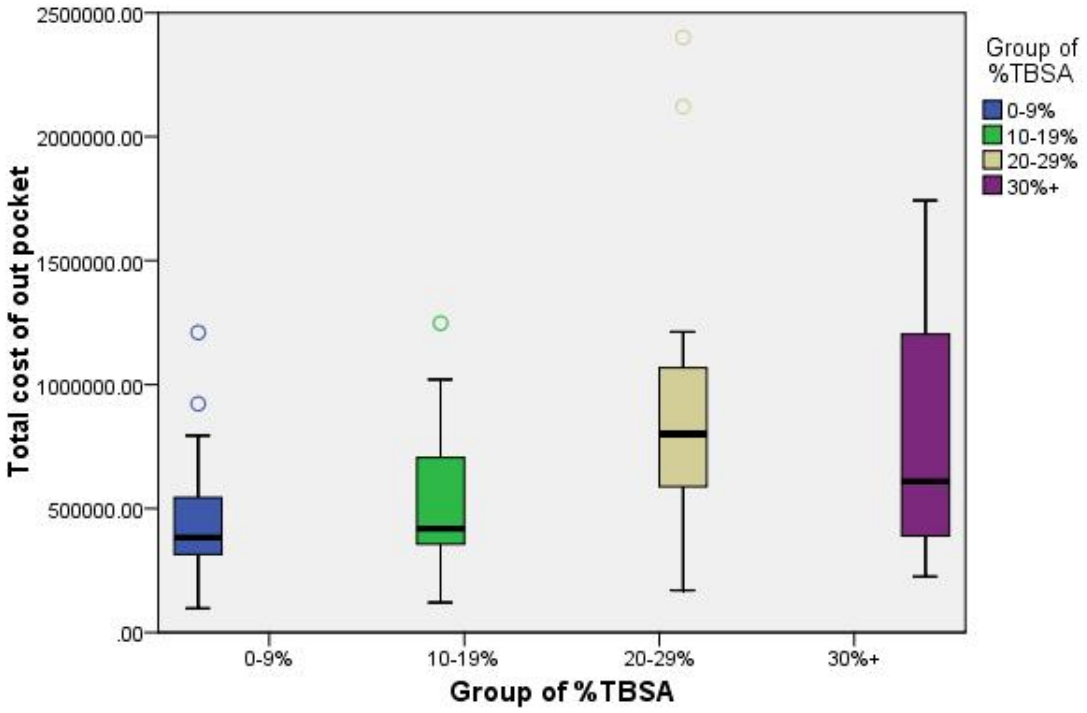

Figure S6. Total Cost of Out-of-Pocket for Same %TBSA Groups